<u>Section 6 General Comment (Overall Comment No. 187)</u>

Section 6 includes a number of broad statements characterizing relationships and mechanisms driving the fate and transport of contaminants in the LPR. However, the associated figures do not provide evidence of the strength of these relationships. Conclusions appear to be drawn based on general expectations of how rivers behave rather than the site-specific data displayed in the figures that, at times, appear to contradict the descriptions provided in the text. For example, at the top of page 74 in Section 6.1.2, the following statement is made:

"The overall dominance of the particulate phase is supported by the strong correlations between contaminant concentrations and suspended solids concentrations within the LPR (Figure 6-2)."

There are two problems with this statement. First, correlations between contaminant concentrations and the suspended solids load do not provide any indication of the contaminant load in the dissolved form. Second, as shown in Figure 6-2, the strength of the relationship between chemical concentration and suspended solids load varies substantially among the different contaminants.

Further discussion of the two concerns raised in Comment No. 187, and associated direction for revision of the RI Report, is provided below.

<u>Item 1</u>

Assume that the total contaminant mass is the sum of the contaminant mass in the water column and the contaminant mass adsorbed to the suspended solids. The concentrations are of the form

$$C = C_w + C_{ss} \qquad \qquad \qquad \qquad$$

measured in units of mass of contaminant per unit volume of water. By definition, the contaminant concentration associated with suspended solids is proportional to the solids load:

$$C_{ss} = k \times TSS$$

Therefore, the correlation between total concentration (*C*) and total suspended solids (*TSS*) is given by:

$$\rho = \frac{\mathrm{cov}(C, TSS)}{\sigma_C \, \sigma_{TSS}} = \frac{\mathrm{cov}(C_w, TSS) + k \times \mathrm{cov}(C_{ss}, TSS)}{\sigma_C \, \sigma_{TSS}}$$

Because the concentration in the dissolved phase is the fraction of contamination not bound to the suspended solids, the first term in the numerator is essentially zero, so the correlation between the total water column concentration (*C*) and total suspended solids (*TSS*) is given by[1]:

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[1] The second equality is established by substituting $\sigma_C = \sqrt{\sigma^2_{C_w} + k^2 \sigma^2_{TSS}}$

$$R = \frac{\text{cov}(\ldots)}{\sigma_C\,\sigma_{TSS}} = \frac{1}{\sqrt{1 + \dfrac{\sigma_{dissolved}^2}{k^2\,\sigma_{TSS}^2}}}$$

which is a function of the ratio of variances of the dissolved fraction and total suspended solids. Both of these are independent of the amount of contaminant in dissolved form. If the dissolved fraction of contaminant is less variable than TSS, this correlation will be large irrespective of the relative proportions of contaminant in dissolved and particulate form. Figure 6-2 provides no evidence to confirm or reject the hypothesis that contaminant transport is dominated by the particulate phase. The RI Report text and associated figures should be revised to include a quantitative discussion confirming or rejecting the hypothesis that contaminant transport is dominated by the particulate phase.

Attachment 1, Table 1: Symbol Definitions

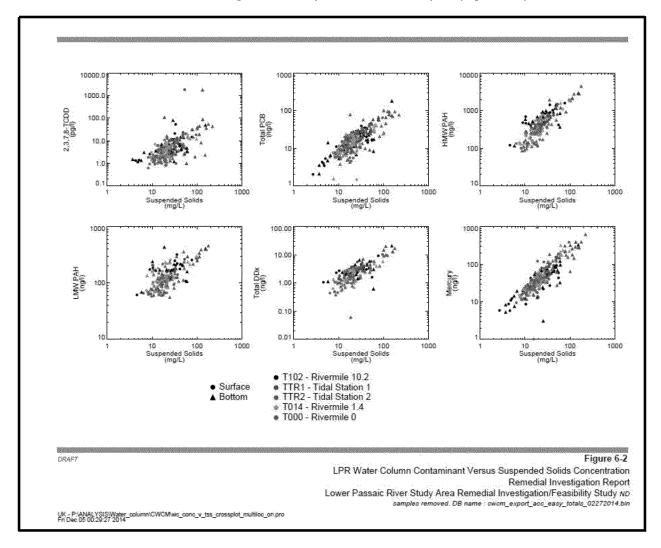| Symbol	Definition
C	Total contaminant concentration, including dissolved and particulate fraction
$C_{dissolved}$	Contaminant concentration in dissolved form
C_{solids}	Contaminant concentration associated with suspended solids
k	Constant of proportionality between concentration associated with suspended solids and the total suspended solids content
TSS	Total suspended solids
R	Correlation coefficient
cov	Covariance
σ_C	Standard deviation of total concentration
σ_{TSS}	Standard deviation of total suspended solids
$\sigma_{dissolved}$	Standard deviation of contaminant concentration in dissolved form

Item 2

Figure 6-2 also illustrates an example of imprecise description of results and potential over-generalization of conclusions. In this case, it is stated that correlations between water column concentrations and total suspended solids are strong for all contaminants, while the plots suggest that the strength of these correlations differs substantially among contaminants. For 2,3,7,8-TCDD, the data in the log-log plot is much more scattered than an elongated ellipsoid that would suggest a strong relationship (such as that seen for mercury). The RI Report should be revised to quantify the strength of these relationships by conducting a regression or correlation analysis.

Moreover, the plots in Figure 6-2 are in log-log scale, which typically enhances the appearance of relationships that may be much weaker than they appear when considered in linear scale. In general, it appears that for any particular level of TSS, the concentrations may range by over an order of magnitude. These plots should be revised to, at a minimum, include the fitted regression lines with confidence and prediction bands so that the reader can judge the strength of the relationships.

Attachment 1, Figure 1: Excerpt from Draft RI Report (Figure 6-2)

Figure 6-2
LPR Water Column Contaminant Versus Suspended Solids Concentration
Remedial Investigation Report
Lower Passaic River Study Area Remedial Investigation/Feasibility Study